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Knowledge, Attitude, and Perception of Optometrists towards Tele-Optometry in India

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ABSTRACT

Background:

The practice of offering patients ocular health and vision care services through telecommunications technology is known as tele optometry. This can involve anything from prescribing and distributing contact lenses or spectacles to doing tests of visual acuity. Anywhere, tele optometry can be a practical and effective approach to get eye treatment.

Methods:

This research is cross-sectional. Already validated KAP questionnaire used to administer a web-based survey to all optometrists throughout India. The questionnaire included an informed consent section. Optometrists must read the consent, which includes a brief description of the study, before beginning the questionnaire. They can begin responding once they have given their consent.

Results:

The poll received responses from 220 optometrists. Of those who responded, 48% were women and 52% were men. North India accounted for 40% of the responses, followed by East India (24%), South India (22%), and West India (14%). 40% of respondents had a bachelor's degree, 30% had a master's or doctoral degree, and only 2% had a doctorate. Urban areas received 69% more responses than rural areas (31%). There is no statistically significant link when the P value is extremely high (>0.05). There is essentially no difference in the usage of tele-optometry between urban and rural practitioners, according to an extremely low chi-square value.

Conclusion:

The results of the study indicate that experienced optometrists do not differ in their understanding of tele-optometry. The majority of them had a high degree of awareness, were eager to include tele-optometry into their practice, and had a favourable opinion of tele-optometry.

Keywords: *Tele-optometry, Optometrists, KAP, Tele communication, Knowledge, Attitude, Perception*

1. INTRODUCTION

The process of providing eye care remotely through telecommunications technology, such as digital imaging, video conferencing, and remote monitoring equipment, is known as telemedicine in optometry (1). The term "telehealth" describes the use of distant technologies to deliver health care, health education, and health information services (2). The use of web-based resources and electronic information in conjunction with cutting-edge digital network technology to support long-distance professional health services, distribute medical safety reports, educate the public about health issues, and carry out public health monitoring is known as telemedicine(3). The focus is on removing geographic obstacles in order to improve health outcomes(4). Telehealth can take several forms, such as video consultations, outreach clinics that transmit test findings for clinical analysis, and the use of mobile phone applications for monitoring (mHealth).

There are other ways to improve remote consultations than technology. It may also be possible to improve the quality of care

by implementing patient-reported outcome measures or using validated questionnaires to improve history taking. every industry has changed as a result of recent advancements in telecommunications technology, including healthcare, where

younger people are more tech-savvy than older people. A subset of telehealth care known as "tele-eye care" is dedicated to providing patients with eye care services through digital medical devices and telecommunications technologies.(5)

Implementing tele-eye care involves diagnosing and tracking eye-related conditions, enabling remote learning opportunities, and giving patients living in remote places access to eye care specialists (6). Mobile technology makes it easier to distribute health information, collect patient data on-site, monitor patients in real time, and access telemedicine worldwide. Healthcare professionals have used online techniques to give follow-up care and consultations to patients in some medical specialties (7). Any initiative's ability to succeed hinges on a number of factors, such as comprehension of the idea, readiness to put it into practice, and the talents required to make it work.(1)

The application of telemedicine for age-related macular degeneration (AMD) in the United States has primarily focused on screening and remote-monitoring systems, with some incorporating artificial intelligence technologies. However, there are currently no extensive programs for the screening or monitoring of AMD (Brady and Garg 2020). (8) Telemedicine is a new technology that is still underutilized in the Indian healthcare system, which emphasizes the need for studies to evaluate patients' and healthcare professionals' attitudes, knowledge, and awareness of telemedicine (9). Families and communities may suffer severe financial repercussions if refractive defects are not corrected. People who have had their vision restored are able to return to their regular jobs and fulfil their conventional family responsibilities. But for a long time, people in rural areas have been unable to afford official vision correction therapies because they are mostly available in metropolitan and peri-urban areas. Southeast Asia needs to develop mid-level eye care specialists, according to the Vision 2020: Right to Sight report. Specialized workers, such as optometrists, are in short supply globally to provide high-quality refraction services (10)

In the last few years, artificial intelligence (AI), which encompasses machine learning and deep learning, has significantly affected society across the globe.(11)Throughout the chosen research, the terms telehealth, telemedicine, and teleophthalmology were used interchangeably. Six different communication modalities were used in the studies: social media message, email, direct text, video visitation, and the phone. We referred to the various virtual platform types discussed in the selected publications as "telemedicine" for the sake of this evaluation. Additionally, when discussing particular study findings, we stuck to the terminology employed in those studies.(12)Teleophthalmology is a field within telemedicine that seeks to enhance access to eye care for individuals living in remote and rural areas globally.(13)

Refractive errors are among the primary factors contributing to vision impairment globally. Timely identification of conditions such as progressive myopia could aid in halting its progression and avoiding permanent harm to one's eyesight.(14)The World Health Organization has described teleophthalmology as the provision of health care services utilizing information and communication technologies (ICT) for the exchange of diagnosis, treatment, and prevention of diseases and injuries, as well as for research and evaluation, and ongoing education of health care providers. (15)During the COVID-19 shutdown, telemedicine and technology have advanced dramatically worldwide, lowering the need for patients to travel and making virtual health care more accessible.(16)Over the past ten years, the prevalence of cerebral visual impairment (CVI), one of the most common causes of visual impairment in children in developed nations, has also increased in India. The tele-rehabilitation model included several important components, such as regular monitoring, access to professional services, easily accessible resources, expert advice, tailored intervention, and parental training.(17)

2. MATERIALS AND METHODS

2.1 Study area:

This cross-sectional descriptive study was conducted in Pan India. The country has a multi-ethnic population of approximately 1.44 billion. East India, encompassing states like West Bengal, Jharkhand and Odisha, had a population around 226.9 million in 2024. Western India estimated population around 173.3 million in 2024.North India, encompassing states like Uttar Pradesh and Bihar, is estimated to have a significant share of India’s total population. Southern states includes Karnataka, Kerala and Tamil Nadu are major Contributors to India’s overall population.

2.2 Study Design:

In this cross-sectional study, we administered a web-based survey to health care workers in India from November 2024 to January 2025 via WhatsApp. The first section of the survey collected baseline demographic information and characteristics of the health care workers, including age, gender, years of experience, employment status, department of work, and computer skills. The second and third sections contained questions of Knowledge, awareness, attitude and perception.

An e-link to the questionnaire, was sent to all consenting optometrists through WhatsApp. The survey could only be completed once from a single email address to avoid double entry. Names and email addresses of practitioners were not

recorded to maintain anonymity. The design of the questions was adapted from a previous online questionnaire with slight modifications to suit the current study objectives (4). The survey consisted of 29 questions and elicited information on demographics and KAP.

Sample size: sample size is 220. Sample size calculation done by this formula

[(Z1-α/2) 2 p(1-p)] /d2 (29).

2.3 Ethical Consideration:

Ethical approval to conduct the study was sought and obtained from the Marengo Asia hospitals Ethics Committee (NEHPL/EC/05/25).

2.4 Data Analysis:

Analysis of data done by Jamovi software, Chi square test used to analyse the data. The Chi-square (χ^2) test of independence is a statistical method used to determine whether there is a significant association between two categorical variables in a population. It helps assess whether the distribution of one variable differs based on the levels of another variable.

3. RESULTS

3.1. General data from the participants

The distribution of gender across four regions of India: East, North, South, and West. Out of the total 220 participants, 105 were female, and 115 were male. North India had the highest representation of both females (44) and males (45), while West India had the lowest female (14) and male (16) counts. across four regions of India: East, North, South, and West. Among the total 220 participants, 69 practice in rural areas and 151 in urban settings. North India shows the highest number of urban practitioners (69), whereas East India has the highest rural practitioners (23). West India has the fewest practitioners in both rural (10) and urban (20) areas. In Educational qualification wise distribution majority of participants have Bachelor degree (68%), Very less have PhD (2%) and master's degree (30%) the majority were employed in hospital (59%) and many worked in urban areas (69%).Majority of them had practiced optometry for less than five years (82%). About one-third of all practitioners rated their computer skills as professional, while the rest were either average or beginners.

Table 1: Characteristics of the study participants (n = 220).

Variable	Subgroups	Frequency	Percentage
Demography :			
Gender	Male	115	52
	Female	105	48
Age group, years	>30	16	7
	21–30	204	93
Region	East India	52	24
	West India	30	14
	North India	89	40
	South India	49	22
Highest educational qualification	Bachelor	150	68
	Masters/OD	66	30
Mode of practice	PhD	4	2
	Retail	42	19

	Self Employed	22	10
	Hospital	129	59
Practice location	Academics	27	12
	Rural	69	31
Level of computer use	Urban	151	69
	Beginner/average user	126	43
Years of practice	Professional user	94	57
	Less than 5 years	181	82
	5 years and above	39	18

Practitioners categorized into two groups; those with less than 5 years of experience and those with 5 or more years of experience. Practitioners divided into two groups who do not use (No) Tele optometry at their work place and who use (Yes) tele-optometry within each experience category, 124 responses received of NO category and 96 Responses received of YES category. Yes responses were less than No responses. P value finds 0.995 which is higher than 0.05 means there is no statistically significant relationship between years of practice and tele-optometry use. P value finds 0.46(greater than 0.05) show that there is no significant relationship between different mode of practice Hospital, Self-Employed, Academic, and Retail and use of tele-optometry at the work place.

3.2. Responses of practitioners on knowledge of tele optometry

Table 2: Responses of participants to items on awareness of tele optometry.

Knowledge items	Subgroups	Frequency	Percentage
Current use of electronic medical records in practice?	No	74	34
	Yes	146	66
Aware of tele-optometry/telemedicine?	No	52	24
	Yes	168	76
Correctly defined tele-optometry?			
	No	62	28
Previously used tele-optometry?	Yes	158	72
	No	147	67
Capacity for tele-optometry use?	Yes	73	33
	No	121	55
Familiarity with tools for tele-optometry?	Yes	99	45

	No	121	55
Had training in tele-optometry?	Yes	99	45
Use tele-optometry at the workplace?	No	174	79
	Yes	46	21
Mode of preferred tele-optometry?	No	123	56
	Yes	97	44
	Audio consultation	24	11
	Text based consultation	22	10
	Video consultation	20	9
	Video and audio consultation combination	154	70

3.3. Responses of practitioners to items on attitude and perception of tele optometry

The full results for percentage responses on the items for attitude and perception are shown in Table 5.A few optometrists (20.6%) perceived tele optometry as an aid in improving clinical decisions. Furthermore, 47% considered tele optometry to be beneficial to clinical practice and 50% thought it was feasible in India. 43% of the practitioners were either concerned or unsure about the possibility of medical errors from tele optometry and the majority (58%) agreed that tele optometry would enable fast completion of tasks. 55% optometrists agreed that tele optometry should be used for consulting patients with ocular conditions.

Table 3: Responses of participants to items on attitude and perception of tele optometry.

Variable	Subgroups	Frequency	Percentage
Attitude items			
Interested in trying mobile app-based optometry?	No	112	51
	Yes	108	49
Willingness to incorporate mobile-app optometry in practice?	No	118	54
	Yes	102	46
Think tele-optometry is feasible in India?	No	110	50
	Yes	110	50
Think is beneficial to practice?	No	117	53
	Yes	103	47

Perception items			
Tele-optometry would induce medical errors?			
	Strongly agree	22	10
	Agree	73	33
	Neutral	99	45
	Disagree	22	10
Tele optometry would enable fast completion of tasks	Strongly disagree	4	2
	Strongly agree	20	9
	Agree	108	49
	Neutral	73	33
Tele optometry would provide more comprehensive health services?	Disagree	18	8
	Strongly disagree	2	1
	Strongly agree	26	12
	Agree	86	39
	Neutral	70	32
Tele optometry would improve clinical decisions?	Disagree	33	15
	Strongly disagree	4	2
	Strongly agree	22	10
	Agree	68	31
	Neutral	90	41
The most important benefit of tele optometry?	Disagree	18	8
	Strongly disagree	22	10
	Could replace the traditional method of services.	24	11
	Facilitate patient's doctor relationship. Readily available and accessible.	48	22
	Saves a lot of time.	66	30

Ocular conditions should be consulted via tele optometry?	Saves money and resources.	73	27
		22	10
All age groups should be consulted via tele optometry?	No		
	Yes	99	45
	Maybe	121	55
	No	95	43
	Yes	97	44
		29	13

The distribution of optometrists' interest in trying mobile app-based optometry across different practice locations—rural and urban. Out of 220 participants, 112 optometrists responded "No," while 108 responded "Yes." A notable trend is observed: a higher proportion of rural practitioners (45 out of 69) expressed interest in trying mobile app-based optometry compared to their urban counterparts (63 out of 151).A chi-square (χ^2) test was conducted to assess the association between practice location and interest in mobile app-based optometry. The χ^2 value is 10.5, with a p-value of 0.001. Since the p-value is well below the standard significance level of 0.05, this result is statistically significant. This indicates a strong association between practice location and interest in mobile app-based optometry. Specifically, rural practitioners appear to be more inclined toward adopting mobile app-based solutions, possibly due to greater challenges in accessibility or resource limitations in rural settings. Chi-square test were used to analyse the association between region and the perceived most important benefit of tele-optometry among 220 optometrists. The most frequently selected benefit overall was “Saves a lot of time” (80 respondents), with North India (37) and East India (20) contributing the most. "Readily available and accessible" was selected by 66 respondents, particularly from North and South India. Other responses included “Facilitates patient-doctor relationship” (49) and “Could replace traditional services” (25).

The chi-square test revealed a statistically significant association between region and perceived benefit ($\chi^2 = 20.4$, $p = 0.016$), suggesting regional differences in how optometrists view the advantages of tele-optometry. North and East India showed stronger preferences for time-saving, while South India leaned more toward accessibility. These variations may reflect regional differences in patient load, infrastructure, and access to in-person care. The association between region and the perception that tele-optometry can provide more comprehensive health services among 220 optometrists. Overall, the majority of respondents either agreed (86) or were neutral (69) on the statement. North India had the highest number of respondents agreeing (41 out of 89), while South India had a larger share expressing neutrality (23 out of 49). East India showed relatively stronger agreement, with 30 respondents either agreeing or strongly agreeing. The chi-square test showed a statistically significant association between region and perception of tele-optometry's comprehensiveness ($\chi^2 = 26.1$, $p = 0.01$). This indicates that attitudes toward the potential of tele-optometry to deliver comprehensive health services vary significantly by region. These differences may reflect variations in healthcare infrastructure, exposure to telehealth practices, or local clinical needs.

Table 4: Knowledge, Attitude and perception in different regions

	Region location	**Attitude Score**	**Perception Score**	**Knowledge Score**
N	East India Rural	23	23	23
	East India Urban	29	29	29
	North India Rural	20	20	20
	North India Urban	69	69	69
	South India Rural	16	16	16

	South India Urban	33	33	33
	West India Rural	10	10	10
	West India Urban	20	20	20
Median Score (IQR)	East India Rural	2 (1)	10 (2)	5 (4)
	East India Urban	2 (2)	9 (3)	4 (3)
	North India Rural	2.5 (2)	9 (1)	4 (1)
	North India Urban	2 (2)	9 (3)	4 (2)
	South India Rural	2.5 (2)	10 (1.25)	4 (3.25)
	South India Urban	2 (2)	9 (2)	4 (3)
	West India Rural	1.5 (1.75)	9.5 (2.5)	4.5 (2.75)
	West India Urban	1.5 (1.25)	9 (1)	3.5 (3)
Kruskal-Wallis p value		0.577	0.652	0.114

4. DISCUSSION

The findings from this study reveal a significant gap between knowledge and practice among optometrists in Trinidad and Tobago regarding tele optometry. While the majority of practitioners demonstrated limited knowledge about tele optometry, they maintained generally positive attitudes and perceptions toward its use in eye care. This contrast suggests a readiness to embrace tele optometry, provided that the necessary support and resources are made available. The low rate of practical experience with tele optometry, despite the availability of appropriate infrastructure during the COVID-19 pandemic, highlights key barriers to implementation. These may include a lack of formal training, unfamiliarity with telehealth platforms, uncertainty about which services can be effectively delivered remotely, and possibly regulatory or systemic limitations. This situation underscores the critical need for comprehensive training programs that equip optometrists with the knowledge and skills to confidently integrate tele optometry into their clinical routines (18). The initial step of verifying widely accessible apps using accepted clinical measurements is provided by this study.

Our research indicates that using these applications to estimate distance and near VA is both doable and reasonably accurate. Televisual acuity testing may benefit greatly from the use of these applications.(19)The study findings indicate that most practitioners possess a good level of knowledge and a generally positive attitude toward tele-eye care. However, the limited practical experience and lack of formal training highlight the need for structured educational interventions. Integrating tele-eye care into undergraduate optometry programs—through dedicated courses and hands-on research opportunities—can play a vital role in preparing future eye care professionals for the digital transformation in healthcare. By equipping students with the necessary skills and understanding of tele-eye care technologies and ethics, academic institutions can ensure that graduates are well-prepared to deliver efficient, accessible, and patient-centred care in an increasingly technology-driven environment (20) .In our study found that results suggest that knowledge, awareness, and perceptions of tele-optometry among optometrists across different regions of India. The findings reveal that while general awareness of tele-optometry is high—particularly in North and East India—practical familiarity and hands-on experience remain limited. A significant proportion of practitioners lack formal training, despite widespread use of electronic medical records, highlighting a crucial gap in professional development. Important developments in healthcare include telemedicine and video consultation, which enable the provision of care remotely(21)Tele-eye care exams are a promising approach that could make it easier for people in many rural or distant places to receive primary eye care, which is crucial for treating vision impairment.(22)The present study provides a broad overview of Chhattisgarh's telemedicine awareness, knowledge, and attitude. According to this study, faculty members are knowledgeable and have a positive attitude.(23)

Demographically, most respondents were young professionals with less than five years of experience, working primarily in urban hospital settings. Although attitudes toward tele-optometry were generally positive, concerns about medical errors and scepticism about its role in clinical decision-making remain. Notably, rural practitioners showed a stronger interest in mobile app-based optometry, likely due to accessibility challenges.

India encounters considerable obstacles in delivering sufficient eye care to its large and varied population, particularly for the 70% of individuals living in rural regions where healthcare resources are frequently lacking. Although urban areas

have somewhat better access to eye care professionals and facilities, rural regions struggle with a scarcity of ophthalmologists and inadequate eye care services, leading to an overwhelmed healthcare system.(24)

The national tele-ophthalmology screening initiative for diabetic retinopathy (DR) in the United Kingdom is recognized as one of the most effective programs. It emphasizes the significance of tracking DR and its associated complications alongside changes in overall glycemic levels.(25)Statistical analysis found no significant link between years of experience or mode of practice and tele-optometry use, suggesting that other factors—such as training, infrastructure, and regional differences—play a more important role. The study highlights the need for structured training, region-specific strategies, and stronger support systems to enhance tele-optometry adoption and integration into routine eye care.

4.1 Knowledge of tele optometry among practitioners

Although the optometrists in T&T had limited knowledge of tele optometry. The fact that the majority had not practiced tele optometry before this study, despite having the capacity to do so at their workplaces during the pandemic, suggests the need for tele optometry training and workshops. This will bridge the knowledge gap and eventually boost the practitioners' confidence to meet expectations (18). It is anticipated that the COVID-19 pandemic will have long-lasting effects. As a result, long-term policy initiatives are also needed, such as telemedicine services, which attempt to remove barriers to medical care caused by physical distance. In order to address concerns about access to these services, such as internet access and advertisements, as well as social programs that assist patients in understanding how to use these services, it is necessary to train and support healthcare professionals and launch government initiatives that offer patients in transitional nations adequate and supportive health care services (26). The study's findings indicate that while many students were familiar with telemedicine, the majority had not had formal training in it and desired to see it incorporated into the curriculum .(27)

4.2 Attitude and perception of tele optometry among practitioners

Many of the practitioners in our study indicated worries regarding the potential for medical errors from teleoptometry and their lack of confidence in the test findings for diagnosis received through teleoptometry, despite the fact that they thought that teleoptometry was advantageous to their practice. This is reasonable given that many optometry procedures entail performing a number of tests, some of which may not be achievable using teleoptometry due to equipment availability, image quality, and result interpretation. Comparable results were noted for teledentistry in Pakistan and Saudi Arabia.(28)

The practitioners in our study felt that tele optometry was not beneficial to their practice, because of the lack of training many expressed concerns about the possibility of medical errors from tele optometry and their lack of confidence in the test results for diagnosis obtained through tele optometry. This is understandable as many optometry practices involve conducting a series of tests that could depend on the availability of equipment, quality of images obtained and interpretation of results, some of which might not be possible with the use of tele optometry.

5. CONCLUSION

The study highlights that while awareness of tele-optometry is relatively high among Indian optometrists—particularly in North and East India—practical familiarity and training remain limited. Most practitioners lack formal education in tele-optometry, despite demonstrating readiness to adopt digital tools like electronic medical records. Perceptions of tele-optometry are generally positive, with many recognizing its benefits in improving efficiency and accessibility. However, concerns about clinical accuracy and the risk of medical errors persist. A statistically significant relationship between practice location and interest in mobile app-based solutions suggests rural practitioners are more inclined toward adopting digital care due to resource constraints. These findings underscore the need for targeted training programs and region-specific strategies to support the effective implementation of tele-optometry in India.

6. Limitations and Future Scope

Since the study is cross-sectional, it captures perceptions at a single point in time and does not account for changes over time or causality between variables. Future research could track changes in optometrists' knowledge and attitudes over time, especially as tele-optometry technologies evolve and become more integrated into clinical practice.

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